(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 411 677 B2

(12) **NEW EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the opposition decision:
14.08.2002 Bulletin 2002/33

(45) Mention of the grant of the patent:
31.01.1996 Bulletin 1996/05

(21) Application number: **90117730.3**

(22) Date of filing: **05.11.1985**

(51) Int Cl.[7]: **H04Q 7/28**, H04B 7/15

(54) **Dispatch trunked radio system**

Bündelfunksystem

Système radio à partage de ressources

(84) Designated Contracting States:
AT BE CH DE FR GB IT LI NL SE

(30) Priority: **31.12.1984 US 687810**

(43) Date of publication of application:
06.02.1991 Bulletin 1991/06

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
85905981.8 / 0 210 181

(73) Proprietor: **MOTOROLA, INC.**
Schaumburg, IL 60196 (US)

(72) Inventor: **Zdunek, Kenneth John**
Schaumburg, Illinois 60194 (US)

(74) Representative: **Dunlop, Hugh Christopher et al**
Motorola,
European Intellectual Property Operations
Midpoint
Alencon Link
Basingstoke, Hampshire RG21 7PL (GB)

(56) References cited:
US-A- 4 369 443

- **IBM Technical Disclosure Bulletin vol. 24, no. 11b, April 1982, New York, US, pp. 5805-5808; D.F. BANTZ: "CONTINUATION PACKET PROTOCOL"**

EP 0 411 677 B2

Description

Field of the Invention

[0001] This invention relates to the field of trunked radio systems and specifically to an improved method and means of dispatch trunked radio control which provides an expanded array of features including uninterrupted private communication between trunked subscriber units. This patent is divided out of European patent application no. EP-A-0 210 181.

Background of the Invention

[0002] Trunked radio systems have developed in response to an ever increasing demand for radio communications services. Previous radio communications systems have expanded to the point where potential users are denied service because the available frequency resource is being utilized. Typically, subscribers using older mobile radio system were constrained to operate on a single frequency, thus limiting the number of users which could be expected to be assigned to that frequency. Trunked radio systems alleviate this inherent spectrum limitation by actively assigning operating frequencies to mobile radios based on channel availability. In other words, the mobile radios used as subscriber units in trunked radio systems are operative on a number of frequencies which are assigned to the subscriber unit 102 based on channel availability.

[0003] A prior trunked radio system is shown and described in United States patent number 4,012,597, entitled "Transmission Trunked Multichannel Dispatch System with Priority Queuing", by Lync et al, filed November 24, 1975 and assigned to Motorola Inc, Schaumburg, Illinois. The trunked radio system described in this patent is referred to as a dispatch trunked radio system. In a dispatch trunked radio system, a mobile radio establishes communication on the system by transmitting a channel request to a system central controller on a predetermined inbound frequency. The central control unit responds to the subscriber unit with a signalling word which authorizes the subscriber unit to operate on a specific communication channel. Typically, the channel request transmitted from the subscriber unit includes information which identifies the subscriber unit to the central control unit. Additionally, the subscriber unit responds to commands sent from the central control unit based on radio ID information included with outbound channel assignment information. Prior dispatch trunked radio systems developed around a basic unifying protocol which communicates radio ID and channel assignment information. However, these systems are inherently limited in the type of features which may be implemented because of the limited amount of information which is communicated between the central control unit and the mobile radios of the dispatch trunked radio system. It is an object of the present invention to provide a more flexible radio communication system.

[0004] From United States patent no. 4,369,443 there is known a communication system with variable length message combination packet.

Summary of the Invention

[0005] According to the invention, there is provided a system as defined in claim 1, and methods according to claims 2 and 3 respectively. In summary, the present invention contemplates an improved dispatch trunked radio system having an expanded unifying signalling protocol which may be advantageously used to implement enhanced system features while remaining compatible with prior dispatch trunked radio systems. The subscriber units of the present invention may be capable of generating and receiving signalling information in accordance with a signal word of concatenated dual-word signalling scheme. The central control unit may also decode and generate signalling information in accordance with a single or concatenated dual-word signalling scheme, and generate channel controlling information in accordance with the signalling scheme of the present invention.

[0006] Accordingly, the present invention has the advantages of providing a dispatch trunked radio system having expanded capabilities which is compatible with prior dispatch trunked radio systems, and of allowing secure individual mobile-to-mobile radio communication without regard to secondary fleet, sub-fleet, or group assignments.

[0007] Other advantages of the present invention are that it provides a method and means for a subscriber unit to receive a private call from another subscriber unit even thought the subscriber unit may be preset to receive calls on the sub-fleet level, and means for a subscriber unit to receive a private call from another subscriber unit to respond to the call in a totally private manner.

Brief Description of the Drawings

[0008] Figure 1 is block diagram of a dispatch trunked radio system.

[0009] Figures 2a and 2b are diagrams of the inbound and outbound signalling word formats of a prior dispatch trunked radio system, before channel encoding.

[0010] Figure 3 is a diagram detailing the individual conversations made possible on a trunked system by execution of the protocol of the present invention.

[0011] Figures 4a and 4b are diagrams of the inbound and outbound signalling word formats of the dispatch trunked radio system of the present invention, prior to channel encoding.

[0012] Figure 5 is a detailed timing diagram detailing the communication between a subscriber unit and the central control unit during the execution of the protocol of the present invention.

[0013] Figure 6 through 8 are flow diagrams detailing the overall operation of the present invention.

[0014] Figure 9 is a diagram showing the contents and encoding the first word of the ISW of the present invention which contains the subscriber unit identification (ID) code of the requesting unit.

[0015] Figure 10 is a diagram showing the contents and encoding of the second ISW word which contains the ID of target mobile.

[0016] Figure 11a describes in details the procedure for encoding each of the ISW's.

[0017] Figure 11b illustrates the form of the dual ISW request as it is presented to the FM modulator of the requesting radio.

[0018] Figure 12 is a diagram showing the encoded first portion of the Inbound Signalling Word of Figure 9.

[0019] Figures 13 is a diagram showing the second portion of the Inbound Signalling Word of Figure 9.

[0020] Figure 14a is a time sequence diagram showing the encoding process associated with the Outbound Signalling Word generated in accordance with the signalling protocol of the present invention.

[0021] Figure 14b is a diagram showing the data word structure which results from the coding process of Figure 14a.

[0022] Figure 15 through 17 are detailed control flow diagrams detailing the step-by-step operation of the present invention.

Detailed Description of the Drawings

[0023] The operation of a dispatch trunked radio system is summarized in conjunction with Figure 1. The dispatch trunked radio system 100 consists of subscriber units 102, 104 (mobiles or portables), trunked repeaters 106, and a trunking central controller 110. The trunked central controller 110 and trunked repeaters 106 may also connected to an "interconnect control unit" (not shown) which serves to connect the trunked repeaters 102 to a public switched telephone network. In the quiescent state all subscriber units monitor the outbound frequency of the trunked repeater 108 which is designated the "control channel".

[0024] To establish a "dispatch call" between a group of units operating on the trunked system 100, a subscriber unit sends a data packet called an ISW (Inbound Signalling Word) on the inbound frequency of the Control Channel repeater. The ISW contains the requesting unit's unique ID code, consisting of a fleet ID and an individual ID, plus a "subfleet" code indicating to which group of units it wants to talk. The ISW also contains a unique "call type" code which indicates that a dispatch call is the type of call desired. The request is forwarded to the Central Controller, which decodes the request, and transmits a data packet called an OSW (Outbound Signalling Word) to all the subscriber units which are monitoring the outbound Control Channel. The OSW is a "channel grant" which contains the subfleet code, the requesting unit's ID code, and the voice channel number assigned for the conversation. The OSW causes the requesting unit to move to the voice channel as listening units. In this way a group of "subfleet" call conversation may be established. If all the voice channels are in use, the Central Controller sends the requesting subscriber unit a "Busy OSW". Further technical description of a fixed end central control unit for a dispatch trunked radio system which may advantageously used with the present invention is set forth in Motorola Inc instruction manual number 68P81047E50-0 entitled "Trunked Radio System Central Controller". Repeaters suitable for use with the present invention are described in Motorola Inc instruction manual number 68P81025E60-D entitled "Micor Base and Repeater Station Manual". Subscriber units suitable for use with the present invention are described in Motorola instruction manual number 68P81066E80-0 entitled "Trunked Syntor X Smartnet/ Dual Operation FM Two-Way Radio". The instruction manuals set forth above are herein incorporated by reference and are available from Motorola Inc, Technical Writing Services Department 1301 E Algonquin Road, Schaumburg, Illinois 60196.

[0025] Referring now to Figure 2, the standard decoded ISW's and OSW's are shown in detail. The ISW's and OSW's are encoded for error correction, detection and packet sync according to the procedures described in Figures 11 a and 14a respectively. The information sources mentioned in block 1102 of Figure 11 and block 1402 of Figure 14 for the standard ISW's and OSW's are shown in Figures 4b and 4a respectively. The procedure for the addition of the outer code word for error detection and the auto-sync sequence, (items 1104, 1106 of Figure 11 and items 1404 and 1406 of Figure 14) are described in United States patent number 3,882,457 entitled "Burst Error Correction Code", filed by En on Jan 30 1974; United States patent number 4,055,832 entitled "One-Error Correction Convolutional Coding System", filed by En on September 24 1975. The procedure for bit interleaving and burst error correction (items 1108 of Figure 11 and item 1408 of Figure 14) is described in United States patent number 4,271,520 entitled "Synchronizing Technique for an Error Correcting Digital Transmission Scheme" filed by Coombes on June 25 1979; and United States patent number 4,312,070 entitled "Digital Encoder-Decoder", filed by Winfield on January 19, 1982, all of the above patents are herein incorporated by reference.

[0026] Referring now to Figure 3, there is shown a diagram detailing the individual conversations made possible by execution of the present invention. The present invention provides for totally private conversations between any two subscriber units on the dispatch trunked radio system. According to the principles of the present invention, a "dual" or "paired" ISW format is used to send requests for various types of radio calls, and a dual OSW is used for the corresponding channel grant. An example of the types of calls which are supported by the sig-

nalling protocol of the present invention areas follows: A subscriber unit can initiate a totally private call to another subscriber unit 104 in the same fleet. The present invention provides that the target unit 104 can respond in a totally private manner to the initiating caller. The principles of the present invention also provide that a subscriber unit can initiate a totally private call to another subscriber unit which is not in the same fleet as is shown by the conversation between units 1 and 3 of Figures 1 and 3. The target unit 103 can respond in a totally private manner to the initiating caller, unit 1. Each line indicates a totally private conversation which may be initiated by any party shown in Figure 3.

[0027] Figures 4a and 4b illustrate signalling word formats which are available in a system using the signalling protocol of the present invention. According to the principles of the present invention, an Inbound Signalling word may be concatenated in a "Dual Word" format to extend the number of inbound instructions available to the Central Controller 110 of Figure 1. The specific organization of the concatenated Inbound Signalling Word of the present invention is shown in Figure 4a.

[0028] As mentioned above, the encoding process of single word ISW's is described in United States patent number 3,882,457, entitled "Burst Error Correction Code", filed by En on January 30, 1974; United States patent number 4,055,832, entitled "One-Error Correction Convolutional Coding System", filed by En on September 24 1975; United States patent number 4,271,520, entitled "Synchronizing Technique for an Error Correcting Digital Transmission Scheme" filed by Coombes on June 25 1979; and United States patent number 4,312,070, entitled "Digital Encoder-Decoder" filed by Winfield on January 19, 1982. All of the above patents are herein incorporated by reference. The encoded ISW's are then sent on the control channel in successive 23.33 millisecond access slots.

[0029] According to the principles of the present invention, OSW's may be concatenated in a "Dual Word" format to extend the number of outbound messages and addresses which may be generated to control the subscriber units. The principles of the present invention provide that decoded dual-word OSW's have a predetermined form.

[0030] If a concatenated signalling word is to be generated by a subscriber unit, the present invention provides that the first word of the signalling sequence must contain a "First Word" identifying code in the Status Field. The second word follows in the word slot immediately following the first and contains a channel number or status indicating code in the 10 bit field. The principles of the present invention provide that the interpretation of the 16 bit "ID" field in the Second Word depends on the contents of the Status Field of the first inbound signalling word.

[0031] The OSW's described above may be encoded for transmission on the outbound control channel for sync, error correction and detection according to patents set forth above. The central controller transmits the encoded dual OSW in successive 23.3 millisecond time slots on the Outbound Control Channel.

[0032] Figure 5 shows a standard dispatch trunked system channel access procedure. To initiates a conversation, the subscriber unit 102 requesting service sends a voice channel request "A" in the form of an ISW (Inbound Signalling Word) to the Fixed End Trunking Controller on the inbound control channel. According to the principles of the present invention, the ISW may take the form of a single or dual word ISW. If a channel is available, the fixed end central controller 110 responds with a voice channel grant "B" in the form of an OSW (Outbound Signalling Word) on the outbound control channel as shown. In the preferred embodiment of the present invention the fixed end central controller 110 responds with a Dual Word OSW if a dual word ISW was received from the subscriber unit. At the same time that the channel grant is send on the outbound control channel, a high speed acknowledge signal is sent on the outbound assigned voice channel. The high speed acknowledge signal contains the group identification code of the requesting unit and is sent at 3600 BPS. After detecting the channel grant on the control channel, the subscriber unit requesting service changes frequencies to the assigned voice channel, and decodes the high speed handshake signal from the fixed end central controller 110. It then responds with the high speed acknowledge tone "C" which indicates to the fixed end central controller 110 that it has successfully reached the voice channel. Upon detecting the highspeed acknowledge signal from the subscriber unit, the fixed end central controller 110 enables the audio path in the assigned repeater, removes the high speed handshake, and starts sending the sub-audible low speed handshake containing the group ID of requesting unit. After sending the high speed acknowledge for a fixed time interval, line "D" shows that the transmitting subscriber unit 102 enables the microphone audio and begins to send voice with a sub-audible low speed handshake signal. According to line "E", receiving mobile units enable the audio to their speakers when they decode the low-speed handshake signal from the fixed end central controller 110. Lines "F" and "G" represent that voice and sub-audible low speed acknowledge, and voice and sub-audible low speed handshake are sent continuously on the inbound and outbound voice channel for the duration of the requesting mobile transmission. The voice channel grant "H" in the form of an OSW is repeated on the outbound control channel for the duration the requesting mobile transmission. When the operator of the requesting unit releases PTT, the radio sends in a sub-audible disconnect signal "I" indicating end of transmission to the fixed end central controller 110. Upon receipt of the mobile disconnect signal, the fixed end central controller 110 disables the audio path in the assigned voice repeater. After a time interval expires after mobile disconnect is received at the trunking fixed end central control-

ler 110, the controller sends a sub-audible central disconnect signal "J" on the outbound voice channel. This signal causes all subscriber units on the voice channel to return to the control channel. The voice channel is now available for reassignment to a new call.

[0033] Figure 17 illustrates the general mechanism by which a requesting (or target) subscriber unit interprets concatenated dual word OSW's in accordance with the method of the present invention. The procedure starts with item 1702 when a valid OSW word is decoded in a receiving radio. Decision 1704 determines whether the decoded word contains a single word code in the 10 bit status field. If a single word code was detected, decision 1726 checks the ID code. If the ID matches that of the requesting unit, then the single word OSW command is processed at item 1730. If decision 1726 does not detect a proper ID, the OSW command is discarded at item 1728. If at decision block 1704, a valid OSW is received with a valid 1st or 2nd word code in the status field, then dual word processing commences with decision block 1706. If the "First Word" code is present in the OSW, then the requesting unit verifies, at decision 1708, that the ID is that of the target unit 104 it requested. If a valid "First Word" is detected then item 1710 places the OSW in a "First Word buffer" to await the receipt of the second word. A time is also started. If the ID is not the ID of the requesting unit, then the OSW is discarded by item 1712.

[0034] If a second word code is present in the decoded OSW, then the 1st word buffer is checked by decisions 1714 and 1716. If no first word has been received, then the second word is discarded by item 1720. If a first word is present in the buffer, then the time started in 1710 is checked by decision 1716. If more than two OSW word times (46 Ms) have elapsed, then the second word cannot be part of the dual word pair, and both words are discarded by items 1718 and 1720.

[0035] If the second OSW word has been received within the proper time interval of the first word (stored in the buffer) then a dual OSW command (busy or channel grant) has been successfully received. The combined command is acted upon by item 1724. The action represented by item 1724 will be discussed more fully in the context of Figures 6 through 8.

[0036] Figures 6 through 8 are flow diagrams detailing the overall operation of the present invention. Figure 6 describes dual word signalling operation from the viewpoint of the mobile subscriber unit requesting an enhanced system feature.

[0037] Typically, a subscriber unit is operated in a quiescent mode represented by item 602 where the subscriber unit is monitoring the outbound control channel in a subfleet mode. In this mode the subscriber unit will respond to calls on a group level. To enter the individual call mode of the present invention, the operator selects a target subscriber via pushbutton or keypad and display, (item 604) and asserts the PTT switch (item 606). A dual word ISW is then transmitted to the fixed end central controller 110 by item 608 on the inbound control channel. The contents and encoding of the first word of the ISW is described in further in conjunction with Figure 9. The first word contains the subscriber unit identification (ID) code of the requesting unit. The contents and encoding of the second ISW word are described in conjunction with Figure 10. The second word contains the ID of the target mobile. Figure 11a describes in detail the procedure for encoding each of the ISW's. The procedure for encoding the dual-word ISW's of the present invention may be the same as the procedure described above for single-word ISW's. Figure 11b illustrates the form of the dual ISW request as it is presented to the FM modulator of the requesting radio.

[0038] After the dual ISW request is sent to the central controller, decision 613 causes the subscriber unit to search for a channel "busy" or channel "grant" command on the outbound control channel from the central controller. According to the principles of the present invention, the channel "busy" or channel "grant" takes the form of a dual word OSW if a dual word ISW was received by the fixed end central controller 110. The contents and encoding of the first word of the dual-word OSW is shown in Figure 12. The first OSW contains the ID of the target unit 104 of the individual call. The contents and encoding of the second OSW are shown in Figure 13. The second OSW contains the I D of the unit requesting the individual call. Figure 14a illustrates in detail the procedure by which the first and second OSW words are encoded. The procedure may be the same as the encoding procedure for standard OSW's. Figure 14b shows the form of dual OSW as it is received from the fixed end central controller 110.

[0039] Referring still to Figure 6, if a dual word "busy" is received by the requesting unit, then item 614 causes the subscriber unit to wait for a dual word channel "grant". When a dual word grant is received immediately after the request, or after a busy has been received, then the ID's in the first and second words are checked by decision 616. According to the principles of the present invention, the first word of the channel grant OSW must contain the ID of the target subscriber unit, the second word must contain the ID of the requesting unit. If the proper ID's are not present, then decision 616 selects item 610 which disregards the dual-word channel grant OSW. The subscriber unit then returns to item 608 and resends the dual ISW request. If the proper ID's are present, then item 618 causes the requesting subscriber unit to moves to the channel assigned by the second word of the dual word grant. Item 620 then enables voice communication on the assigned channel. The high-speed handshake and low-speed handshake signals described in Figure 5 are derived using the ID code of the subscriber unit requesting the dual word private call.

[0040] When the subscriber unit dekeys on the voice channel and system disconnect is detected by the subscriber unit 102, as shown in Figure 5, "J", then decision 622 and item 624 return the subscriber unit to the trunk-

ing control channel, and dual-word private call common operation commences with routine 700 of Figure 7. If the system disconnect has not been detected on the voice channel, the requesting unit continues communication on the voice channel at item 620.

[0041] Referring now to Figure 7, there is another flow diagram of the overall operation of the protocol of the present invention. When a radio is in the dual-word private call mode on the trunked system control channel, and a dual-word request has not been sent by the unit in response to an operator generated PTT, it is in a mode of operation "common" to a requesting or target radio.

[0042] If a dual word grant is received by item 702 and PTT has not been detected by decision 704, then control passes to "Target Mobile" 800 operation Figure 8. The first word must contain the radio's own ID, and the second word of the dual OSW must contain the ID of the unit previously requested. If these ID's are not present in the dual word, the command is discarded by decision 708, and the radio continues to wait for dual word grants.

[0043] If a dual word grant has snot been received, but the operator has asserted PTT, then control passes back to Figure 7, point A for a requesting subscriber unit. A radio which has previously been a "target" radio uses the ID latched as the requesting unit to call that unit back.

[0044] If the operator has not asserted PTT, but the operator has left the private mode by releasing the private button or selecting a group call mode, then operation returns to the group call mode of Figure 7, point "C".

[0045] Referring now to Figure 8, the target radio operation for dual-word private call begins with item 802 in the group call mode on the control channel. If decision 804 detects a dual-word grant according to the procedure described in Figure 17, then decision 806 checks the ID's. If the first word contains the radio's own ID, and the second word contains a channel number in the status field, then the ID in the second word is assumed to be the ID of the initiating mobile and item 808 stores the ID to be used in responding to the initial caller if required. Item 810 then moves the target subscriber to the assigned voice channel and commences voice channel communication, expecting the high speed handshake and low speed handshake signals to be served from the ID of the initiating radio which was stored by item 808 above. Voice channel communications continue until decision 812 detects system disconnect as described in Figure 5 "J". Item 814 then returns the target unit 104 to the control channel.

[0046] If the mobile radio operator has engaged the private mode by depressing a button or other means, then the ID of the requesting unit stored by item 808 above is latched, and decision 816 passes control to the common operation routine 700 of Figure 7. If the private mode has not been engaged by the target radio operator, decision 816 selects entry point 802 and the group call mode continues.

[0047] Figure 9 is a diagram showing the contents and encoding of the first word of the ISW of the present invention which contains the subscriber unit identification (ID) code of the requesting unit. The information source for the first ISW word "A" consists of 21 bits comprised of the 16 bit requesting subscriber unit ID, followed by the 5 bit binary sequence 01000. The ISW encoding process "B" converts the 21 bit information source into a 78 bit data stream "C" to be sent over the channel. The process "B" is further described in conjunction with Figure 11a. Starting with the 21 bit information sequence, the outer code 1104 and the auto-sync sequences 1106 are added according to the teachings of the patents set forth above.

[0048] Figure 10 is a diagram showing the contents and encoding of the second ISW word which contains the ID of target mobile. The information source for the second ISW word "A" consists of 21 bits comprised of the 16 bit target subscriber unit ID followed by the 5 bit binary sequence 01001. The ISW encoding process "B" converts the 21 bit information source into a 78 bit data stream "C" to be sent over the channel. The process "B" is further described in the patents set forth above.

[0049] Figure 11b illustrates the form of the dual ISW request as it is presented to the FM modulator of the requesting radio. The two 78 bit ISW sequences derived according to the procedure described above are presented to the FM modulator of the subscriber unit as two serial binary sequences separated by the 16 bit binary pattern 101010.

[0050] Referring now to Figure 12, the 27 bit information sequence of Figure 4a consists of the 16 bit ID field of the target subscriber unit 104, followed by the binary number 1, and then followed by the 10 bit binary sequence "A" 1100001000. The OSW encoding process "B" converts the 27 bit information field to 84 bits "C" to be sent over the RF channel.

[0051] The process "B" is further described in conjunction with Figure 14a. Starting with the 27 bit information sequence 1402, 10 bits of parity for error detection are added by item 1404. The random error correction and bit interleaving are provided for in the patents set forth above. This process results in a sequence of 78 bits. An 8 bit binary synchronization sequence is added as a preamble by item 1410 for a totally of 84 bits.

[0052] Figure 13 is a diagram showing the second portion of the Outbound Signalling Word of Figure 4a. The 27 bit information sequence consists of the 16 bit ID field of requesting subscriber unit, followed by the binary number 1, and then followed by the 10 bit binary sequence "A" which corresponds to a channel assignment or a predesignated "busy" code. The OSW-encoding process "B" converts the 27 bit information field to 84 bits "C" to be sent over the RF channel.

[0053] The process "B" is further described in conjunction with Figure 14a. Starting with the 27 bit information sequence 1402, 10 bits of parity for error detection are added by. item 1404. The random error correction and bit interleaving are provided for in the patents

set forth above. This process results in a sequence of 78 bits. An 8 bit binary synchronization sequence is added as a preamble by item 1410 for a total of 84 bits. Figure 14b shows the two 84 bit sequences described above in the form in which they are presented to the FM modulator of the control channel transmitter as two consecutive binary sequences.

[0054] Figure 15 illustrates how the Trunking Central Controller decides that two independantly decoded I SW's indeed form a concatenated dual word ISW from a mobile or portable unit. The procedure starts when a single valid ISW word is decoded on the Inbound Control Channel at entry 1502. If decision 1504 detects a valid "single-word code" is in the 5 bit ISW status field, then control is passed to item 1522 which handles single word commands in accordance with conventional call processing techniques. If decision 1504 detects a dual-word code, then decision 1506 determines whether the first word code, or second word codes have been received. If the ISW received is a first word, the it is stored in a "First Word Buffer" by item 1510, and the time of reception is recorded.

[0055] If a second word ISW has been received, then the First Word Buffer is checked by decision 1508. If no first word is present, then item 1514 discards the second word ISW. IF a first word is present in the buffer, then decision 1512 checks the time of reception. If the first word was received more than two word durations ago (46 ms) then the 2nd word ISW just received, and the first word ISW in the buffer, are discarded by item 1520.

[0056] If the first word ISW in the buffer was received within two word times (46 ms), then a valid, concatenated ISW consisting of the first word in the buffer, and the second word just decoded, has been received and item 1516 combines the two ISW words. Item 1518 sends the dual ISW as a combined command to appropriate processing in the Central Controller. In the preferred embodiment of the present invention, the 2nd word code ($09)(hex) initiates the Dual-Word Private call processing of Figure 16.

[0057] Figure 16 describes how the trunked system central controller processes dual word private call requests from mobiles and portables. The processing described here takes place between blocks 608 and 612 of Figure 6 (Requesting Mobile Processing). Control is passed to the private call procedure 1602 of the present invention after a dual-word private call ISW has been successfully decoded as described in Figure 15.

[0058] First decision 1604 checks the ID contained in the 2nd word of the dual ISW. This is the ID of the target radio. If the target subscriber ID is already active on the trunked system, then a dual word "busy" OSW is sent to the requesting unit by the fixed end central controller 110 by item 1610. As mentioned above, Figures 12, 13, and 14 describe the specific formating and encoding of dual word OSW's. When a channel is released from serving a call by decision 1612, then the private call 2 procedure is restarted to determine whether the "busy" OSW can be replaced by a "channel grant" OSW. Otherwise, decision 1612 and item 1610 continue to send the dual-word "busy OSW".

[0059] If the target mobile is not active as determined by decision 1604, then the ID contained in the first word is assumed to be that of the initiating unit. This ID is also checked by decision 1606 to see whether it is currently involved in a channel assignment on the trunked system. If it is active, then a dual-word "busy" is sent by item 1610 according to the procedure described above.

[0060] If the initiating and target subscriber unit I D's are not involved in trunked system calls, then item 1608 determines whether a channel is available for assignment to the private call. If a channel is not available, item 1610 is selected and the "busy" control sequence is entered as described above.

[0061] If the initiating and target Unit ID's are not involved in trunked system calls, and a channel is available for assignment, the a dual word OSW grant is sent on the outbound control channel to the initiating and target units. The format and encoding of this dual word OSW was described above in conjunction with Figure 12, 13 and 14.

[0062] After the dual word grant is sent, Voice Channel communications can commence at item 1620, as described according to the procedures of Figures 5, 6, 7, and 8.

[0063] Accordingly, an improved dispatch trunked radio system which includes an expanded unifying signalling protocol has been described which the improved dispatch trunked radio system of the present invention may be advantageously used to implement enhanced system features while remaining compatible with prior dispatch trunked radio systems. The subscriber units of the present invention are capable of generating and receiving signalling information in accordance with a single word or concatenated dual-word signalling scheme. The central control unit also decodes and generates signalling information in accordance with a single or concatenated dual-word signalling scheme, and generates channel controlling information in accordance with the signalling scheme of the present invention. While the teachings of the present invention have been disclosed in the context of channel assignments the dual-word signalling protocol of the present invention may advantageously used to provide an array of other system features.

Claims

1. A dispatch trunked radio communication system (100) comprising at least a transmitter (102,108) and a receiver (104,102), wherein said transmitter includes means for transmitting message (ISW) comprised of channel request or grant signalling information, and selectively comprised of :

a first data packet, wherein said first data packet includes at least one dedicated field comprised of coded data that is first data packet information, wherein said coded data can selectively be an indication that a second associated data packet will follow said first data packet; and

an optional second data packet, wherein said second data packet includes at least one field that comprises coded data that is second data packet information;

and wherein said receiver includes means for decoding (110), upon receiving a transmitted message, said message, said means for decoding comprising:

means for determining if said message comprises said first data packet, and if so, determining if said dedicated field indicates that a second data packet will be subsequently transmitted; and

means for determining if said message comprises said second data packet, and if so, accepting said second data packet if a first data packet having said dedicated field indicating that said second data packet would be so transmitted was received within a predetermined period of time prior to receiving said second data packet

2. A method (1500, 1600, 1700) of transmitting and receiving messages, the messages comprising channel request or channel grant signalling information, between a transmitter and a receiver of a dispatch trunkel radio communication system, comprising the steps of:

in the transmitter.

a. transmitting a first data packet having at least one dedicated field contained therein, wherein said dedicated field is comprised of coded data that is first data packet information, and wherein said dedicated field can selectively be an indication that an associated second data packet will be transmitted following transmission of said first data packet; and

b. optionally transmitting a second data packet, wherein said second data packet includes at least one field that comprises coded data that is second data packet information, provided that said second data packet is only transmitted following transmission of a first data packet having said indication that an associated second data packet will be subsequently transmitted; and in the receiver:

c. decoding, if received by said receiver, said first data packet to determine its contents, such that:

1. if said first data packet does not include said indication that an associated second data packet will be transmitted, said receiver accepts information contained in said first data packet;

2. if said first data packet does include said indication that an associated second data packet will be transmitted, said receiver does not yet accept information contained in said first data packet; and

d. decoding, if transmitted by said transmitter and received by said receiver, said second data packet to determine its contents, such that

1. if said second data packet was not preceded by reception, within a predetermined period of time, of a first data packet having an indication that an associated second data packet would be subsequently transmitted, said receiver will not accept information contained in said second data packet; and

2. if said second data packet was preceded by reception, within a predetermined period of time, of a first data packet having an indication that an associated second data packet would be subsequently transmitted, said receiver will accept information contained in both said second data packet and in said first data packet.

3. A method (1500,1700) of receiving at least one data packet in a receiver of a dispatch trunkel radio communication system wherein said data packet comprises channel request or channel grant signalling information, and may be selectively comprised of:

a first data packet that includes data that is first data packet information, and wherein said first data packet can selectively include an indication that an associated second data packet will be transmitted following transmission of said first data packet; and

an optional second data packet, wherein said second data packet includes at least some data that is second data packet information; the method comprising the steps of:

a. receiving a data packet;

b. decoding said data packet to determine its contents;

c. if said data packet includes an indication that an associated second data packet will be transmitted, storing at least some information representative of said data packet in memory to await reception of said second data packet;

d. if said data packet includes data that is first data packet information, but does not include said indication that an associated second data packet will be transmitted, accepting information contained in said data packet; and
e if said data packet includes data that is second data packet information, accepting information contained in said data packet, unless reception of said data packet did not occur within a predetermined time period following reception of a first data packet that included said indication that an associated second data packet will be transmitted.

Patentansprüche

1. Dispatch-Bündelfunk-Fernmeldesystem (100), das wenigstens einen Sender (102, 108) und einen Empfänger (104, 102) umfasst, bei dem der Sender eine Einrichtung zum Senden von Nachrichten (ISW) enthält, die aus Kanalanforderungs- oder -gewährungs-Signalisierungsinformationen bestehen und selektiv bestehen aus:

einem ersten Datenpaket, wobei das erste Datenpaket wenigstens ein zugeordnetes Feld umfasst, das aus codierten Daten besteht, die erste Datenpaketinformation sind, wobei die codierten Daten selektiv eine Angabe sein können, dass ein zweites zugehöriges Datenpaket dem ersten Datenpaket folgen wird, und

einem wahlfreien zweiten Datenpaket, wobei das zweite Datenpaket wenigstens ein Feld enthält, das codierte Daten umfasst, die zweite Datenpaketinformation sind,

und wobei der Empfänger eine Einrichtung (110) enthält, die nach dem Empfangen einer gesendeten Nachricht die Nachricht decodiert, wobei die Einrichtung zum Decodieren umfasst:

eine Einrichtung, die feststellt, ob die Nachricht das erste Datenpaket umfasst, und wenn ja, feststellt, ob das zugeordnete Feld anzeigt, dass ein zweites Datenpaket nachfolgend gesendet werden wird, und

eine Einrichtung, die feststellt, ob die Nachricht das zweite Datenpaket umfasst, und wenn ja, das zweite Datenpaket annimmt, wenn ein erstes Datenpaket mit dem zugeordneten Feld, das anzeigt, dass das zweite Datenpaket so gesendet werden wird, innerhalb einer vorbestimmten Zeitdauer vor dem Empfangen des zweiten Datenpakets empfangen wurde.

2. Verfahren (1500, 1600, 1700) zum Senden und Empfangen von Nachrichten, wobei die Nachrichten Kanalanforderungs- oder Kanalgewährungs-Signalisierungsinformationen umfassen, zwischen einem Sender und einem Empfänger eines Dispatch-Bündelfunk-Fernmeldesystems, das die folgenden Schritte umfasst:

in dem Sender:

a. Senden eines ersten Datenpakets mit wenigstens einem darin enthaltenen zugeordneten Feld, wobei das zugeordnete Feld aus codierten Daten besteht, die erste Datenpaketinformation sind, und wobei das zugeordnete Feld selektiv eine Angabe sein kann, dass ein zugehöriges zweites Datenpaket nach der Übertragung des ersten Datenpakets gesendet werden wird, und

b. wahlfrei Senden eines zweiten Datenpakets, wobei das zweite Datenpaket wenigstens ein Feld enthält, das codierte Daten umfasst, die zweite Datenpaketinformation sind, vorausgesetzt, dass das zweite Datenpaket nur nach dem Senden eines ersten Datenpakets mit der Angabe, dass ein zugehöriges zweites Datenpaket nachfolgend gesendet werden wird, gesendet wird, und

in dem Empfänger:

b. Decodieren, wenn durch den Empfänger empfangen, des ersten Datenpakets, um seinen Inhalt zu ermitteln, so dass

1. wenn das erste Datenpaket die Angabe nicht enthält, dass ein zugehöriges zweites Datenpaket gesendet werden wird, der Empfänger die in dem ersten Datenpaket enthaltene Information annimmt;

2. wenn das zweite Datenpaket die Angabe enthält, dass ein zugehöriges zweites Datenpaket gesendet werden wird, der Empfänger die in dem ersten Datenpaket enthaltene Information noch nicht annimmt, und

d. Decodieren, wenn von dem Sender gesendet und von dem Empfänger empfangen, des zweiten Datenpakets, um seinen

Inhalt zu ermitteln, so dass:

1. wenn dem zweiten Datenpaket nicht innerhalb einer vorbestimmten Zeitdauer der Empfang eines ersten Datenpakets mit einer Angabe, dass ein zugehöriges zweites Datenpaket nachfolgend gesendet werden wird, vorausgegangen ist, der Empfänger die in dem zweiten Datenpaket enthaltene Information nicht annehmen wird, und

2. wenn dem zweiten Datenpaket innerhalb einer vorbestimmten Zeitdauer der Empfang eines ersten Datenpakets mit einer Angabe, dass ein zugehöriges zweites Datenpaket nachfolgend gesendet werden wird, vorausgegangen ist, der Empfänger sowohl die in dem zweiten Datenpaket als auch die in dem ersten Datenpaket enthaltene Information annehmen wird.

3. Verfahren (1500, 1700) zum Empfangen wenigstens eines Datenpakets in einem Empfänger eines Dispatch-Bündelfunk-Fernmeldesystems, wobei das Datenpaket Kanalanforderungs- oder Kanalgewährungs-Signalisierungsinformationen umfasst und selektiv bestehen kann aus:

einem ersten Datenpaket, das Daten enthält, die erste Datenpaketinformation sind, und wobei das erste Datenpaket selektiv eine Angabe enthalten kann, dass ein zugehöriges zweites Datenpaket nach dem Senden des ersten Datenpakets gesendet werden wird, und

einem wahlfreien zweiten Datenpaket, wobei das zweite Datenpaket wenigstens einige Daten enthält, die zweite Datenpaketinformation sind, wobei das Verfahren die folgenden Schritte umfasst:

a. Empfangen eines Datenpakets;

b. Decodieren des Datenpakets, um seinen Inhalt zu ermitteln;

c. wenn das Datenpaket eine Angabe enthält, dass ein zugehöriges zweites Datenpaket gesendet werden wird, Speichern wenigstens einiger Information, die für das Datenpaket repräsentativ ist, im Speicher, um den Empfang des zweiten Datenpakets zu erwarten;

d. wenn das Datenpaket Daten enthält, die erste Paketdateninformation sind, aber nicht die Angabe enthält, dass ein zugehöriges zweites Datenpaket gesendet werden wird, Annehmen der in dem Datenpaket enthaltenen Information, und

e. wenn das Datenpaket Daten enthält, die zweite Paketdateninformation sind, Annehmen der in dem Datenpaket enthaltenen Information, es sei denn, dass der Empfang des Datenpakets nicht innerhalb einer vorbestimmten Zeitdauer nach dem Empfang eines ersten Datenpakets stattgefunden hat, das die Angabe enthielt, dass ein zugehöriges zweites Datenpaket gesendet werden wird.

Revendications

1. Système de communication radio à ressources partagées de distribution (100) comprenant au moins un émetteur (102,108) et un récepteur (104,102), dans lequel ledit émetteur comprend un moyen pour l'émission de messages (ISW) comprenant des informations de signalisation de demande de canal ou d'attribution de canal et constitués, de façon sélective, par :

- un premier paquet de données comprenant au moins un champ dédié constitué de données codées constituant une première information de paquet de données, dans lequel lesdites données codées peuvent être sélectivement une indication selon laquelle un second paquet de données associé suit ledit premier paquet de données ; et
- un second paquet de données en option comprenant au moins un champ constitué de données codées qui sont une seconde information de paquet de données ;

et dans lequel ledit récepteur comprend un moyen (110) qui décode, lors de la réception d'un message émis, ledit message, ledit moyen de décodage comprenant :

- un moyen pour déterminer si ledit message comprend ledit premier paquet de données et, si oui, pour déterminer si ledit champ dédié indique qu'un second paquet de données est ensuite émis ; et
- un moyen pour déterminer si ledit message comprend ledit second paquet de données et, si oui, pour accepter ledit second paquet de données si un premier paquet de données ayant ledit champ dédié indiquant que ledit se-

cond paquet de données sera émis a été reçu dans une période de temps prédéterminée avant la réception dudit second paquet de données.

2. Procédé (1500, 1600, 1700), pour émettre et recevoir des messages, les messages comprenant des informations de signalisation de demande de canal ou d'attribution de canal, entre un émetteur et un récepteur d'un système de communication radio à ressources partagées de distribution, comprenant les étapes suivantes :

dans l'émetteur :

- émettre un premier paquet de données ayant au moins un champ dédié, où ledit champ dédié est constitué de données codées qui sont une information de premier paquet de données, et où ledit champ dédié peut être, de façon sélective, une indication qu'un second paquet de données associé sera émis suite à l'émission dudit premier paquet de données ; et
- émettre en option un second paquet de données, où ledit second paquet de données comprend au moins un champ comprenant des données codées qui sont une information de second paquet de données, étant entendu que ledit second paquet de données n'est émis que suite à l'émission d'un premier paquet de données ayant ladite indication selon laquelle un second paquet de données associé sera ensuite émis ; et

dans le récepteur :

- décoder, s'il y a réception par ledit récepteur, ledit paquet de données pour déterminer son contenu de telle façon que :
  - si ledit premier paquet de données ne comprend pas ladite indication selon laquelle un second paquet de données associé sera émis, ledit récepteur accepte l'information contenue dans ledit premier paquet de données ;
  - si ledit premier paquet de données comprend ladite indication selon laquelle un second paquet de données associé sera émis, ledit récepteur n'accepte pas encore l'information contenue dans ledit premier paquet de données ; et
- décoder, s'il y a émission par ledit émetteur et réception par ledit récepteur, ledit second paquet de données pour déterminer son contenu de telle façon que :
  - si ledit second paquet de données n'était pas précédé d'une réception dans une période de temps prédéterminée d'un premier paquet de données ayant une indication selon laquelle un second paquet de données associé sera ensuite émis, ledit récepteur n'acceptera pas l'information contenue dans ledit second paquet de données ; et
  - si ledit second paquet de données était précédé d'une réception dans une période de temps prédéterminée d'un premier paquet de données ayant une indication selon laquelle un second paquet de données associé sera ensuite émis, ledit récepteur acceptera l'information contenue, à la fois, dans ledit second paquet de données et dans ledit premier paquet de données.

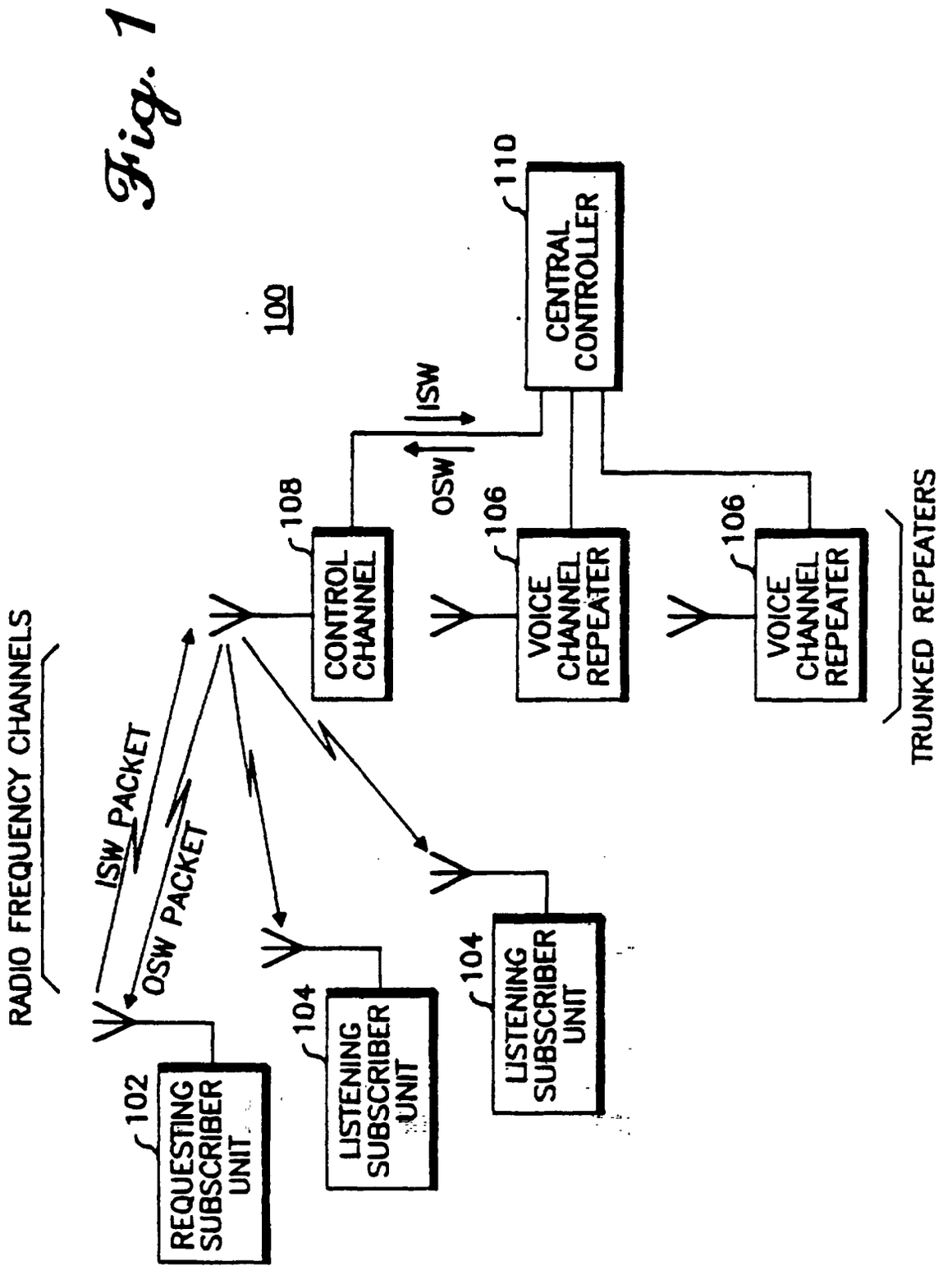
3. Procédé (1500, 1700) de réception d'au moins un paquet de données dans un récepteur d'un système de communication radio à ressources partagées de distribution, où au moins un paquet de données comprend des informations de signalisation de demande de canal ou d'attribution de canal, et peut être constitué, de façon sélective, par :

- un premier paquet de données comprenant des données constituant une information de premier paquet de données, et où ledit premier paquet de données peut comprendre, de façon sélective, une indication selon laquelle un second paquet de données associé sera émis suite à l'émission dudit premier paquet de données ; et
- un second paquet de données en option, où ledit second paquet de données comprend au moins certaines données constituant une information de second paquet de données ; le procédé comprenant les étapes suivantes :
  - recevoir un paquet de données ;
  - décoder ledit paquet de données pour déterminer son contenu ;
- si ledit paquet de données comprend une indication selon laquelle un second paquet de données associé sera émis, stocker au moins une certaine information représentant ledit paquet de données en mémoire pour attendre la réception dudit second paquet de données ;
- si ledit paquet de données comprend des don-

nées constituant une information de premier paquet de données, mais ne comprend pas ladite indication selon laquelle un second paquet de données associé sera émis, accepter l'information contenue dans ledit paquet de données ; et

- si ledit paquet de données comprend des données constituant une information de second paquet de données, accepter l'information contenue dans ledit paquet de données à moins que la réception dudit paquet de données ne survienne dans une période prédéterminée de temps suite à la réception d'un premier paquet de données comprenant ladite indication selon laquelle un second paquet de données associé sera émis.

Fig. 1


100
RADIO FREQUENCY CHANNELS
ISW PACKET
OSW PACKET
REQUESTING SUBSCRIBER UNIT
102
LISTENING SUBSCRIBER UNIT
104
LISTENING SUBSCRIBER UNIT
104
CONTROL CHANNEL
108
ISW
OSW
CENTRAL CONTROLLER
110
VOICE CHANNEL REPEATER
106
VOICE CHANNEL REPEATER
106
TRUNKED REPEATERS

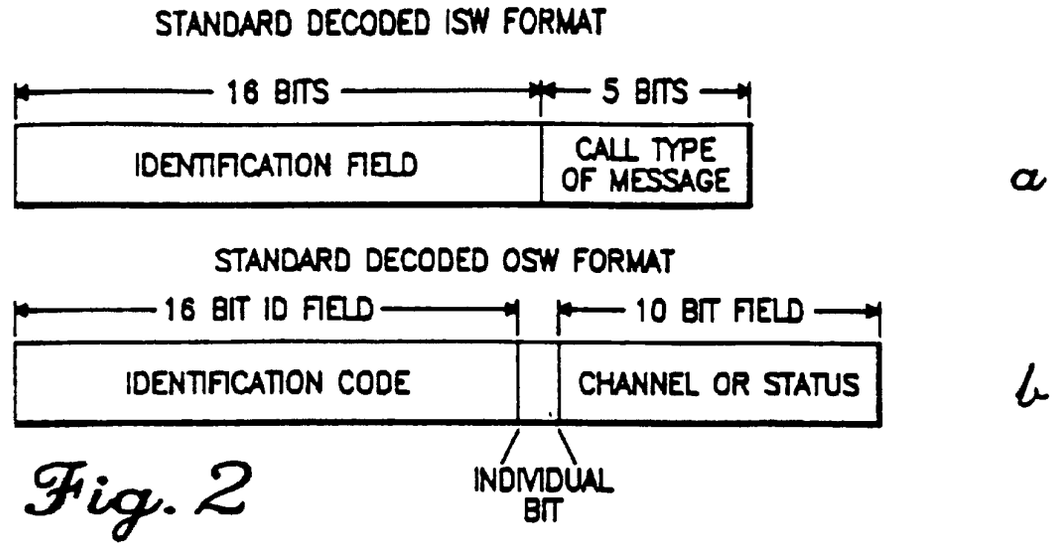


Fig. 2

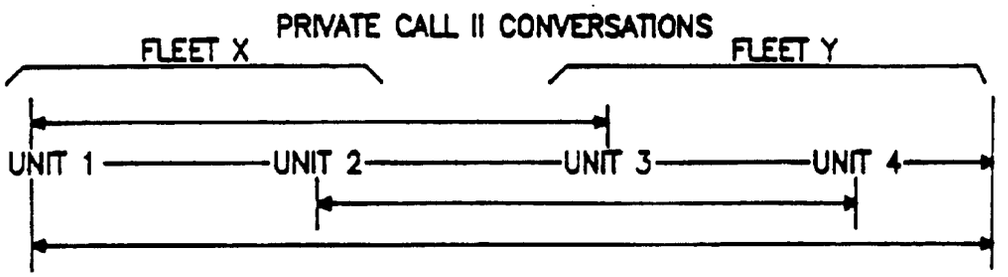


Fig. 3

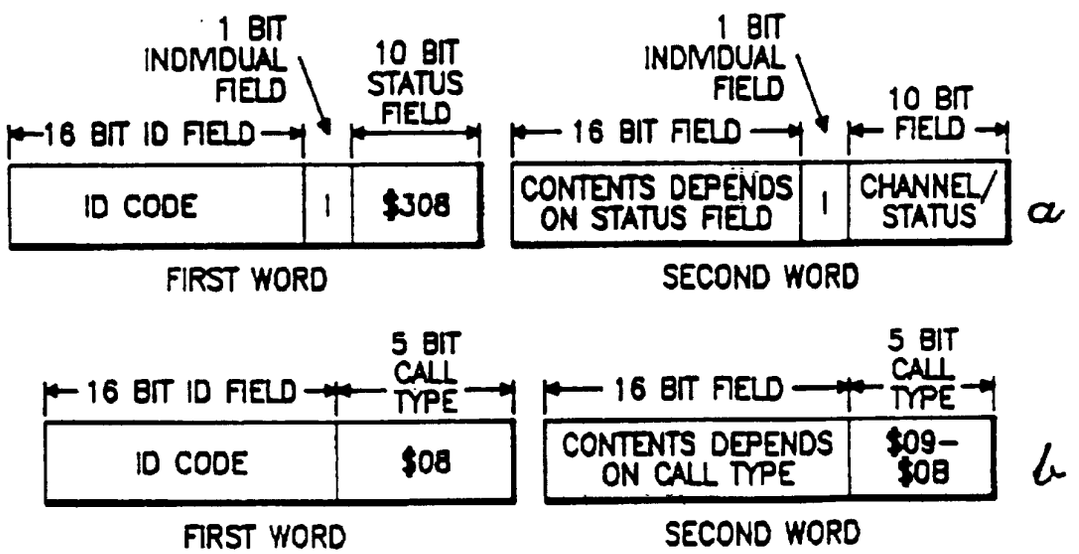
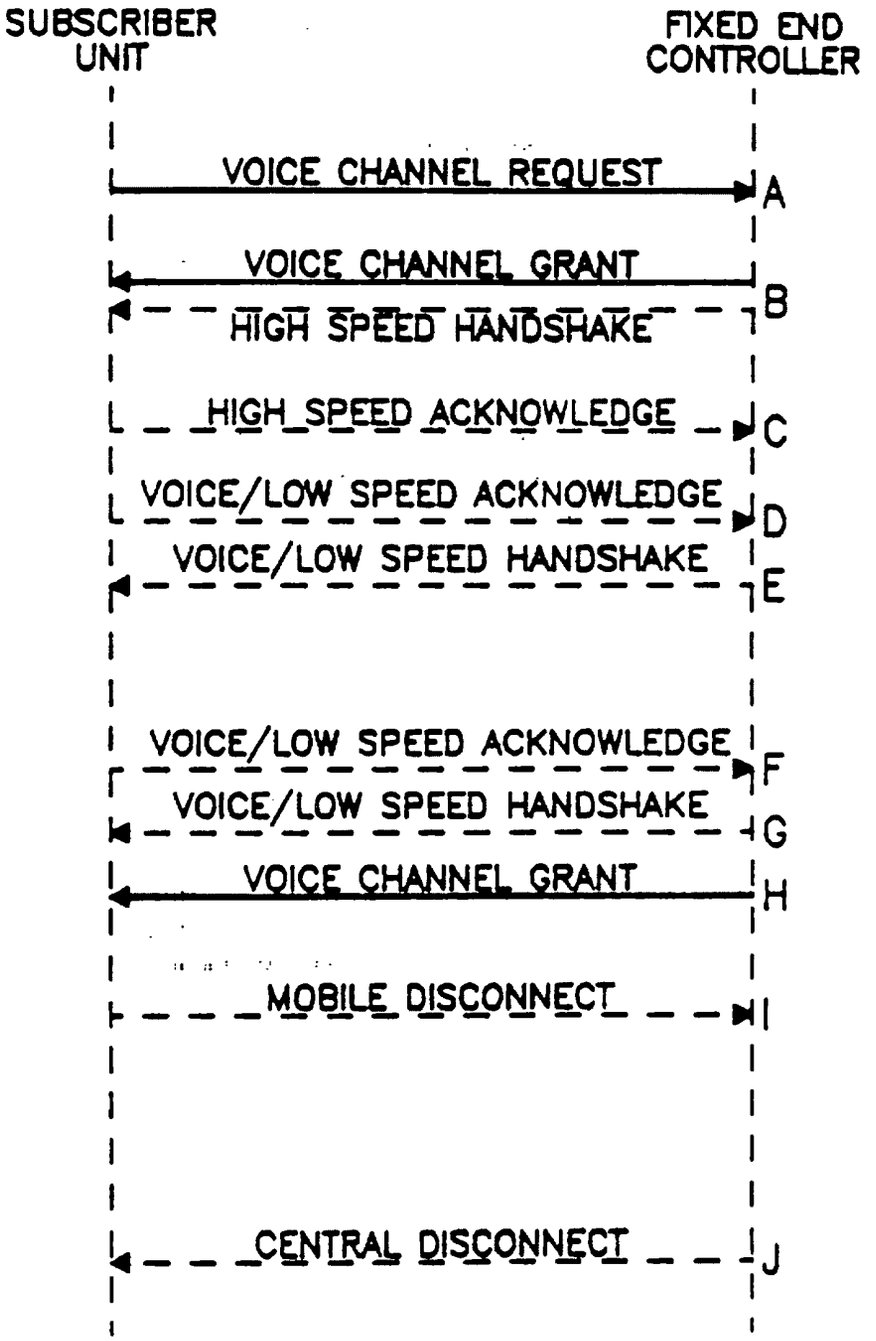


Fig. 4

Fig. 5


SUBSCRIBER UNIT
FIXED END CONTROLLER
VOICE CHANNEL REQUEST
A
VOICE CHANNEL GRANT
B
HIGH SPEED HANDSHAKE
HIGH SPEED ACKNOWLEDGE
C
VOICE/LOW SPEED ACKNOWLEDGE
D
VOICE/LOW SPEED HANDSHAKE
E
VOICE/LOW SPEED ACKNOWLEDGE
F
VOICE/LOW SPEED HANDSHAKE
G
VOICE CHANNEL GRANT
H
MOBILE DISCONNECT
I
CENTRAL DISCONNECT
J

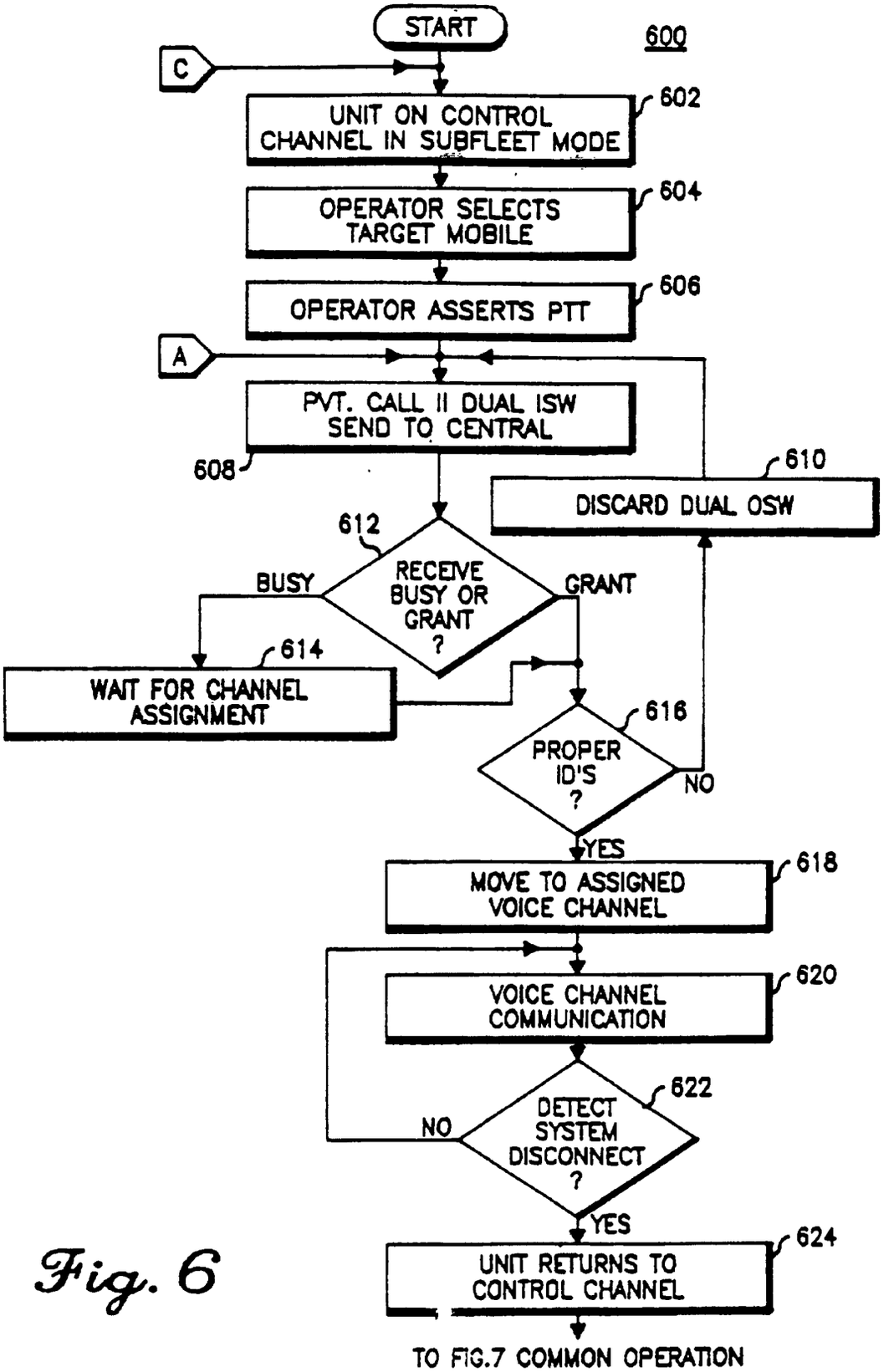

START
600
C
UNIT ON CONTROL CHANNEL IN SUBFLEET MODE
602
OPERATOR SELECTS TARGET MOBILE
604
OPERATOR ASSERTS PTT
606
A
PVT. CALL II DUAL ISW SEND TO CENTRAL
608
610
DISCARD DUAL OSW
612
RECEIVE BUSY OR GRANT ?
BUSY
GRANT
614
WAIT FOR CHANNEL ASSIGNMENT
616
PROPER ID'S ?
NO
YES
618
MOVE TO ASSIGNED VOICE CHANNEL
620
VOICE CHANNEL COMMUNICATION
622
DETECT SYSTEM DISCONNECT ?
NO
YES
624
UNIT RETURNS TO CONTROL CHANNEL
TO FIG.7 COMMON OPERATION

Fig. 6

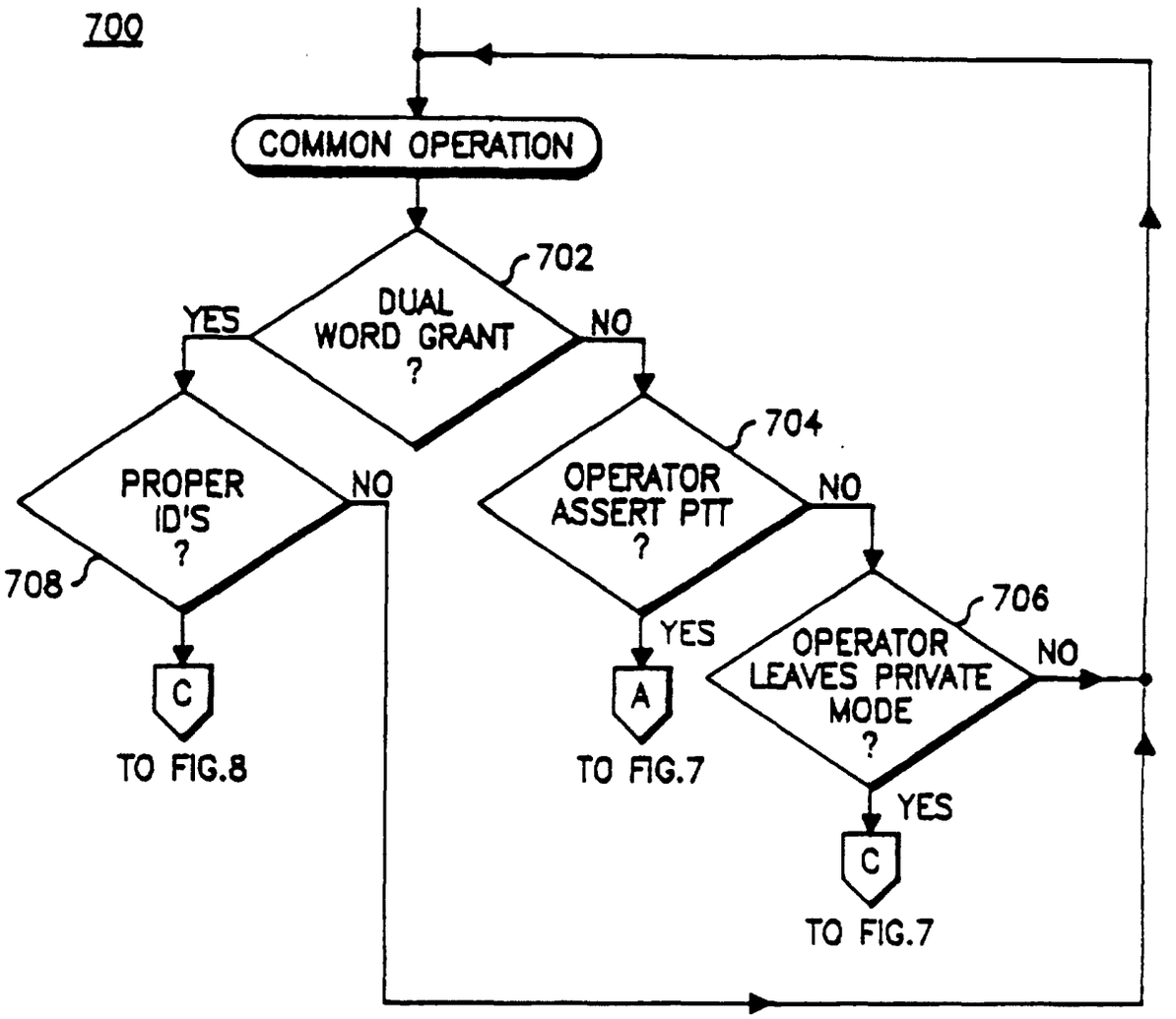

700
COMMON OPERATION
702
DUAL WORD GRANT ?
YES
NO
PROPER ID'S ?
708
NO
C
TO FIG.8
704
OPERATOR ASSERT PTT ?
NO
YES
A
TO FIG.7
706
OPERATOR LEAVES PRIVATE MODE ?
NO
YES
C
TO FIG.7

Fig. 7

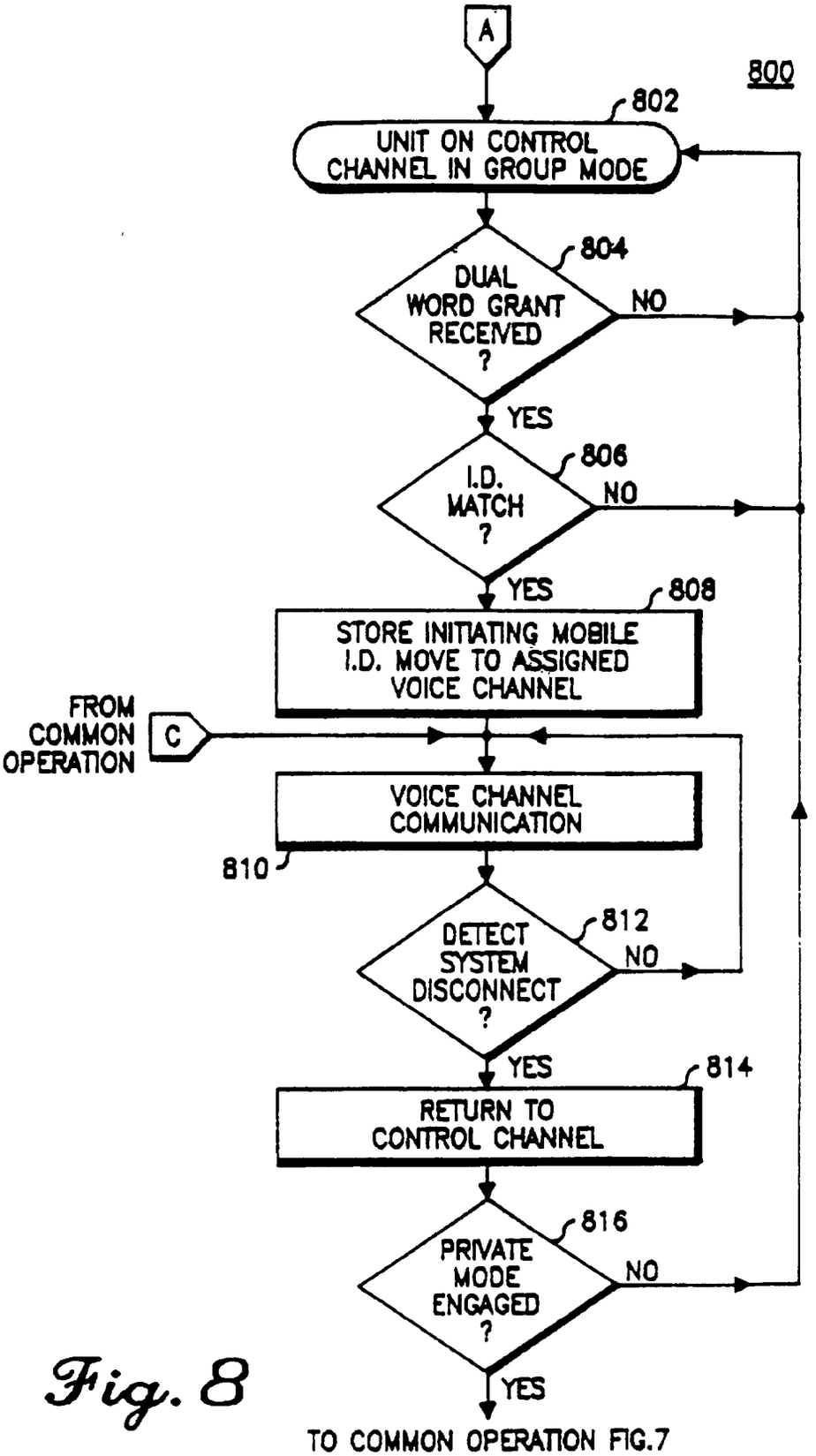

A
800
802
UNIT ON CONTROL CHANNEL IN GROUP MODE
804
DUAL WORD GRANT RECEIVED ?
NO
YES
806
I.D. MATCH ?
NO
YES
808
STORE INITIATING MOBILE I.D. MOVE TO ASSIGNED VOICE CHANNEL
FROM COMMON OPERATION
C
VOICE CHANNEL COMMUNICATION
810
812
DETECT SYSTEM DISCONNECT ?
NO
YES
814
RETURN TO CONTROL CHANNEL
816
PRIVATE MODE ENGAGED ?
NO
YES
TO COMMON OPERATION FIG.7

Fig. 8

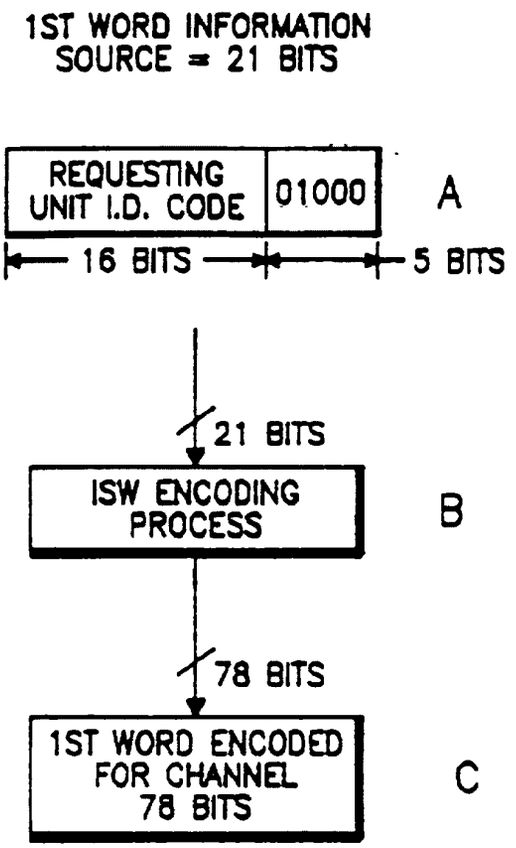

1ST WORD INFORMATION
SOURCE = 21 BITS
REQUESTING UNIT I.D. CODE
01000
A
16 BITS
5 BITS
21 BITS
ISW ENCODING PROCESS
B
78 BITS
1ST WORD ENCODED FOR CHANNEL 78 BITS
C

Fig. 9

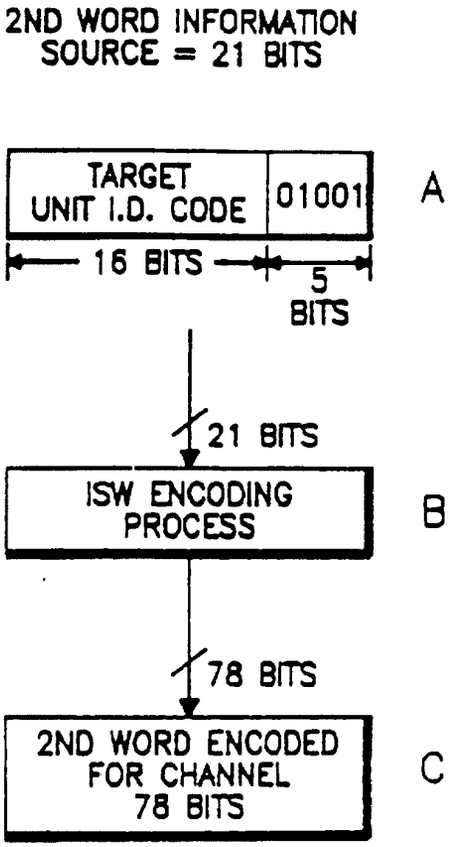

2ND WORD INFORMATION
SOURCE = 21 BITS
TARGET UNIT I.D. CODE
01001
A
16 BITS
5 BITS
21 BITS
ISW ENCODING PROCESS
B
78 BITS
2ND WORD ENCODED FOR CHANNEL 78 BITS
C

Fig. 10

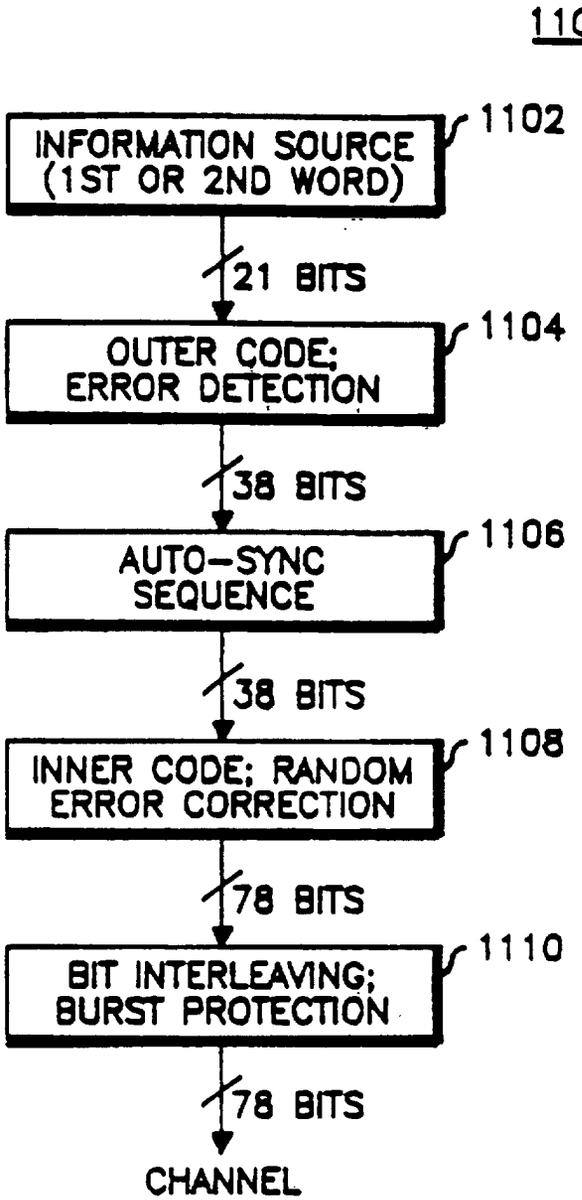

1100
INFORMATION SOURCE (1ST OR 2ND WORD)
1102
21 BITS
OUTER CODE; ERROR DETECTION
1104
38 BITS
AUTO-SYNC SEQUENCE
1106
38 BITS
INNER CODE; RANDOM ERROR CORRECTION
1108
78 BITS
BIT INTERLEAVING; BURST PROTECTION
1110
78 BITS
CHANNEL

Fig. 11a

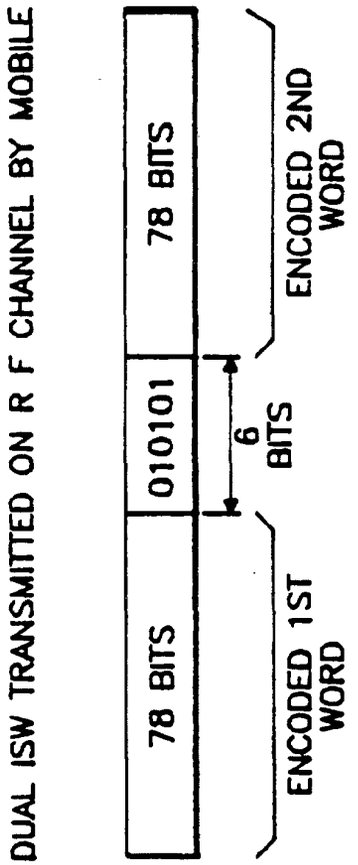


Fig. 11b

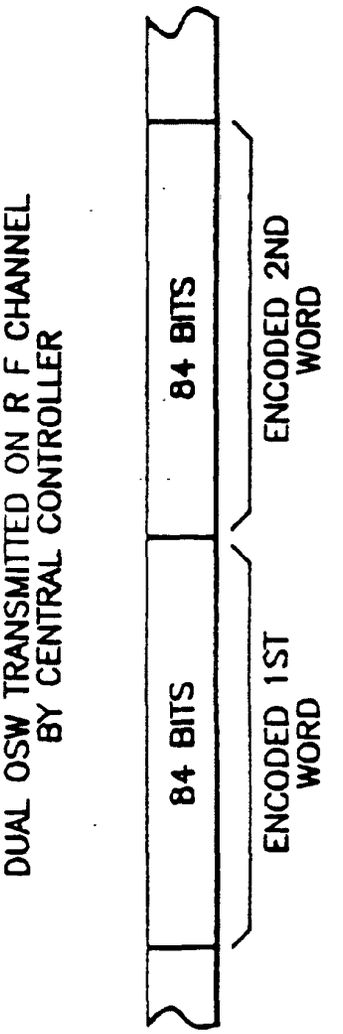


Fig. 14b

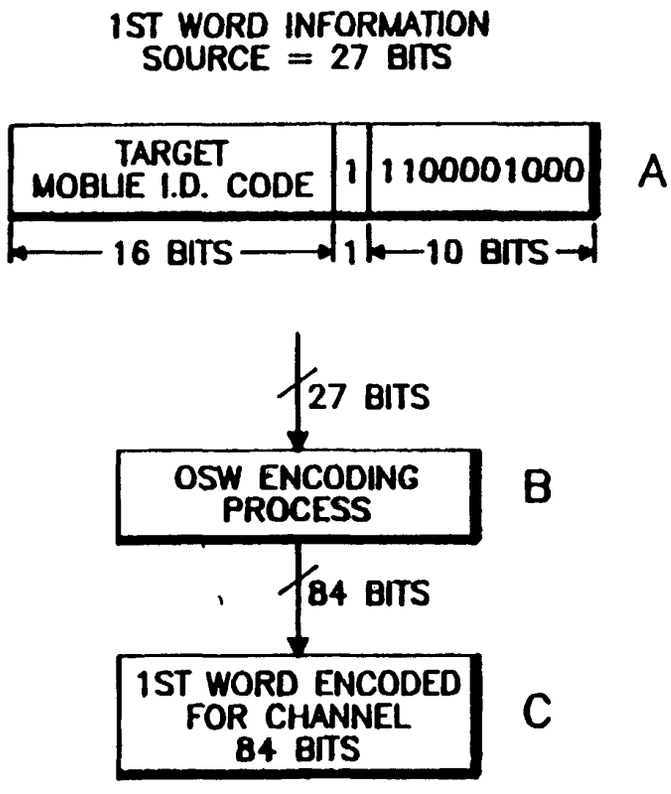

1ST WORD INFORMATION
SOURCE = 27 BITS
TARGET
MOBLIE I.D. CODE
1
1100001000
A
16 BITS
1
10 BITS
27 BITS
OSW ENCODING
PROCESS
B
84 BITS
1ST WORD ENCODED
FOR CHANNEL
84 BITS
C

Fig. 12

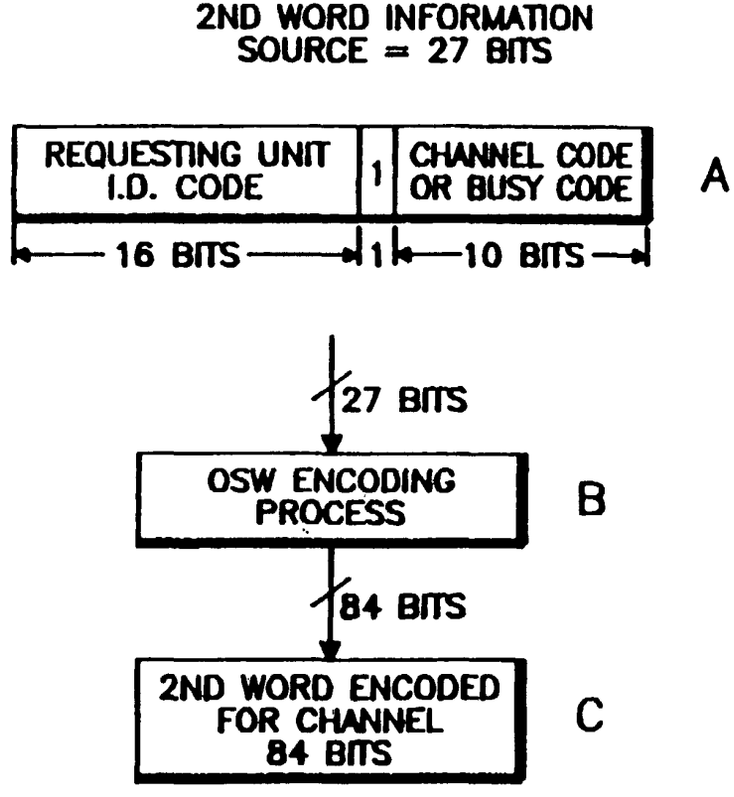

2ND WORD INFORMATION
SOURCE = 27 BITS
REQUESTING UNIT
I.D. CODE
1
CHANNEL CODE
OR BUSY CODE
A
16 BITS
1
10 BITS
27 BITS
OSW ENCODING
PROCESS
B
84 BITS
2ND WORD ENCODED
FOR CHANNEL
84 BITS
C

Fig. 13

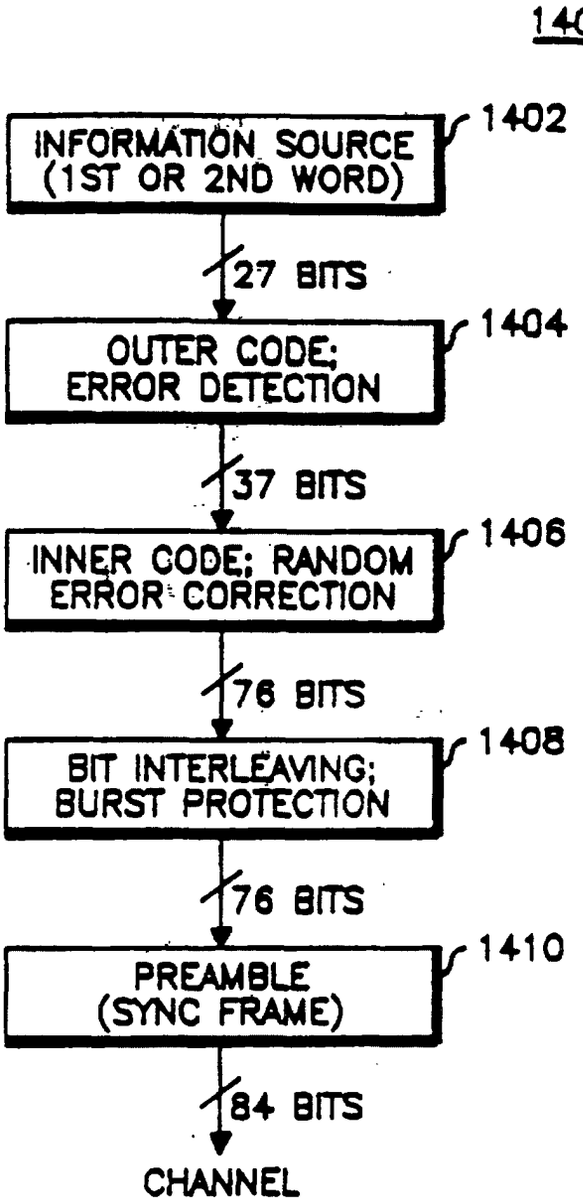

1400
INFORMATION SOURCE (1ST OR 2ND WORD)
1402
27 BITS
OUTER CODE; ERROR DETECTION
1404
37 BITS
INNER CODE; RANDOM ERROR CORRECTION
1406
76 BITS
BIT INTERLEAVING; BURST PROTECTION
1408
76 BITS
PREAMBLE (SYNC FRAME)
1410
84 BITS
CHANNEL

Fig. 14a

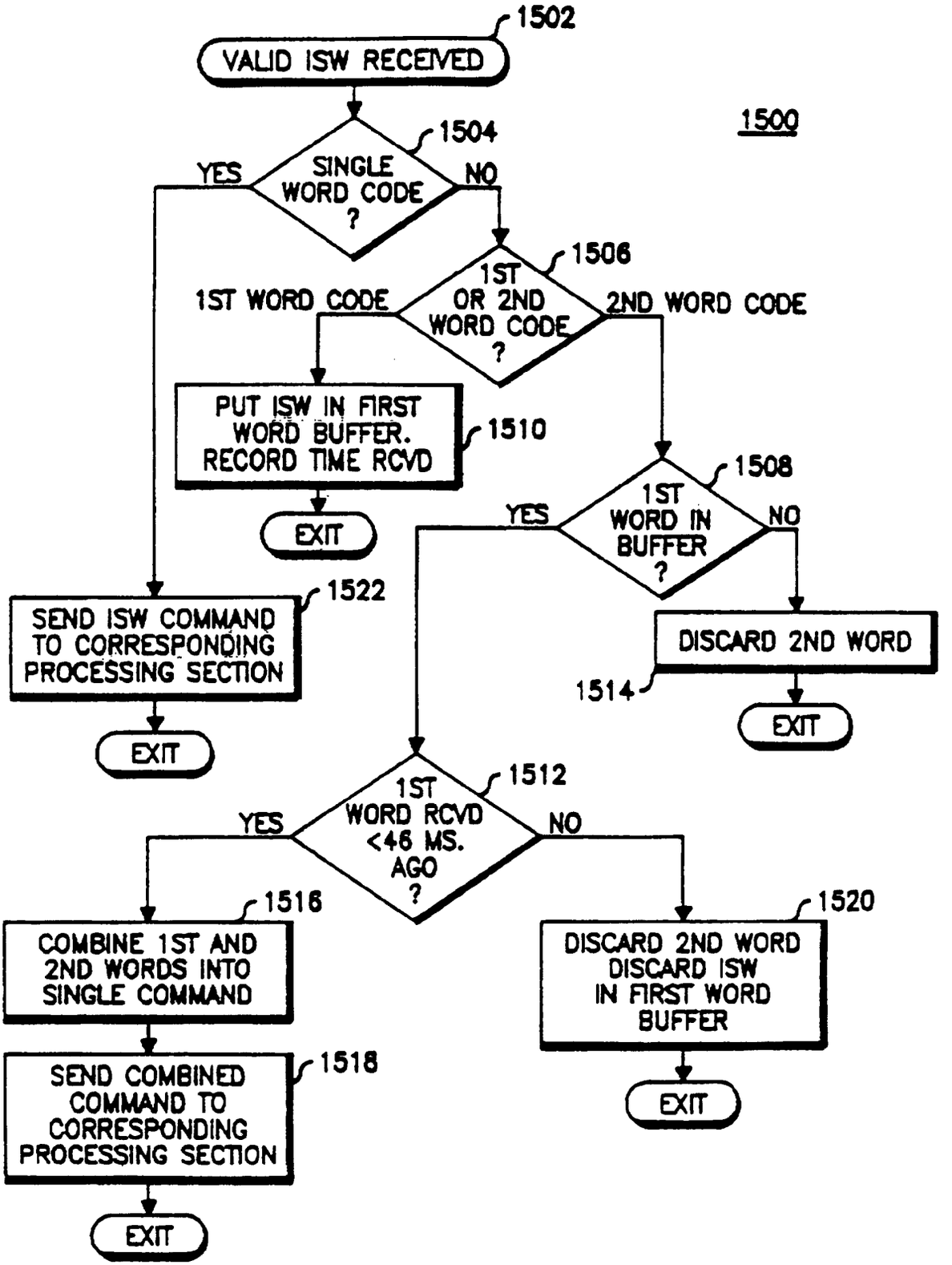

1502
VALID ISW RECEIVED
1500
1504
SINGLE WORD CODE ?
YES
NO
1506
1ST OR 2ND WORD CODE ?
1ST WORD CODE
2ND WORD CODE
PUT ISW IN FIRST WORD BUFFER. RECORD TIME RCVD
1510
EXIT
1508
1ST WORD IN BUFFER ?
YES
NO
SEND ISW COMMAND TO CORRESPONDING PROCESSING SECTION
1522
EXIT
DISCARD 2ND WORD
1514
EXIT
1512
1ST WORD RCVD <46 MS. AGO ?
YES
NO
1516
COMBINE 1ST AND 2ND WORDS INTO SINGLE COMMAND
SEND COMBINED COMMAND TO CORRESPONDING PROCESSING SECTION
1518
EXIT
1520
DISCARD 2ND WORD DISCARD ISW IN FIRST WORD BUFFER
EXIT

Fig. 15

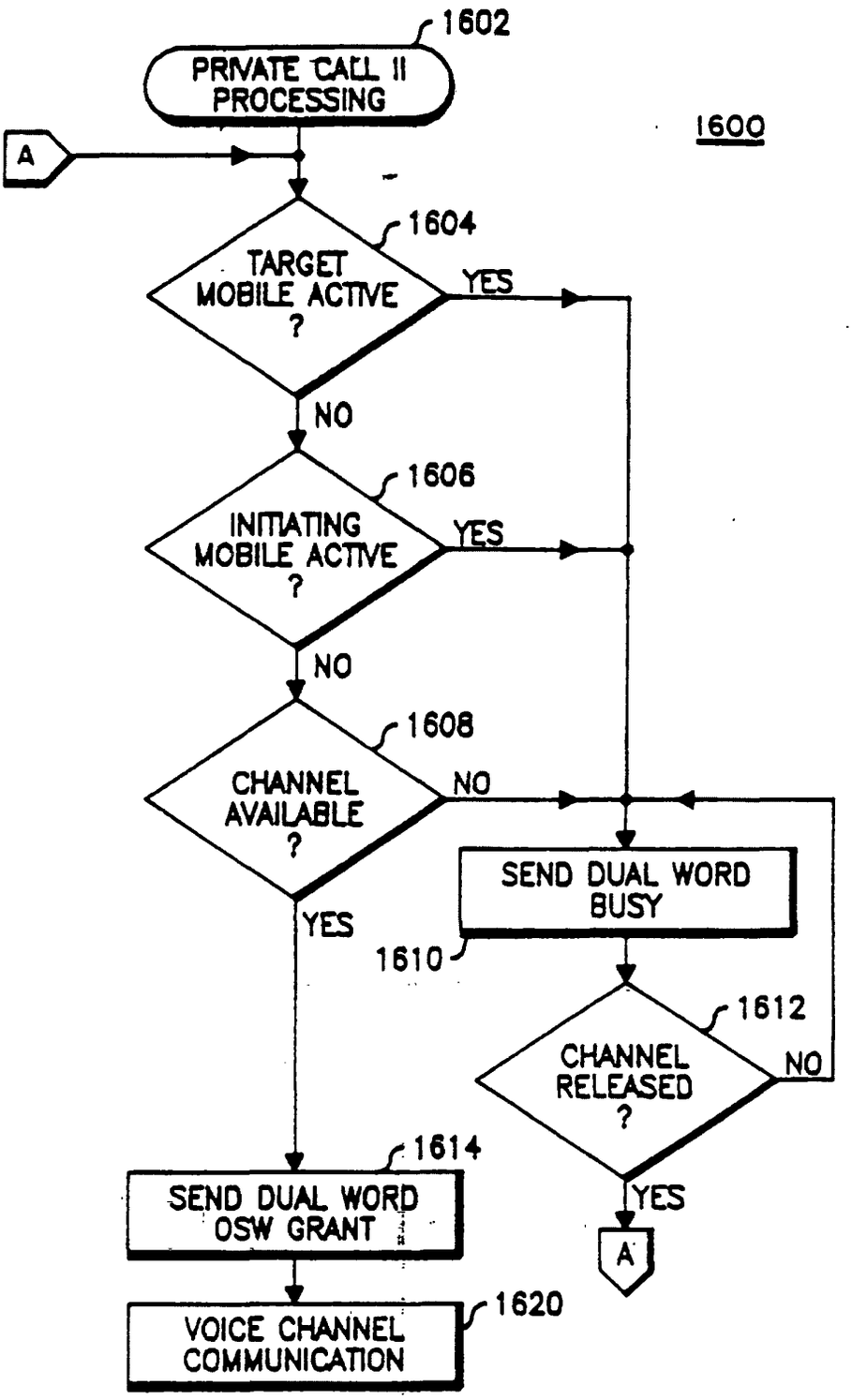
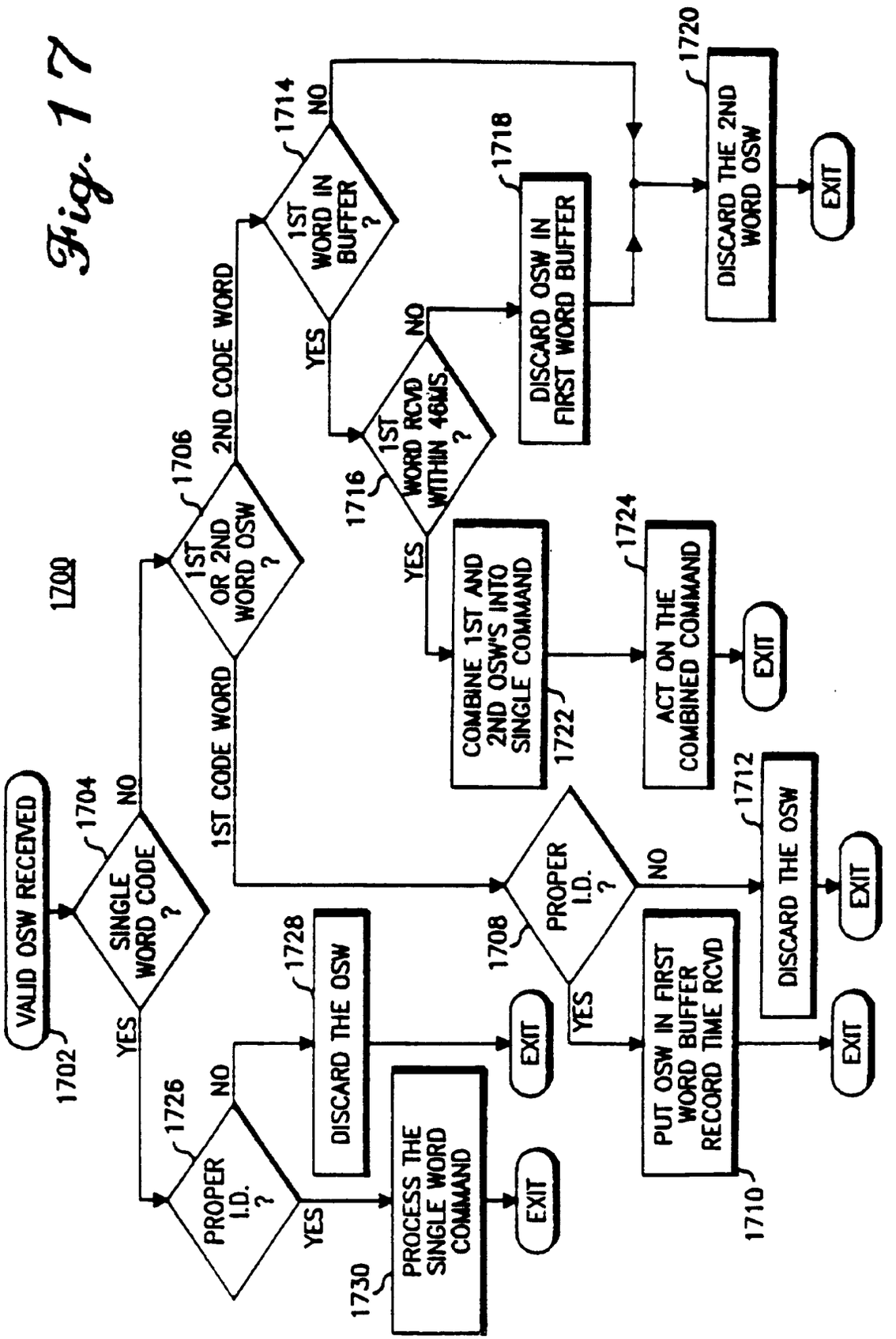

1602
PRIVATE CALL II PROCESSING
1600
A
1604
TARGET MOBILE ACTIVE ?
YES
NO
1606
INITIATING MOBILE ACTIVE ?
YES
NO
1608
CHANNEL AVAILABLE ?
NO
YES
SEND DUAL WORD BUSY
1610
1612
CHANNEL RELEASED ?
NO
YES
A
1614
SEND DUAL WORD OSW GRANT
1620
VOICE CHANNEL COMMUNICATION

Fig. 16

Fig. 17


1700
VALID OSW RECEIVED
1702
SINGLE WORD CODE ?
1704
NO
YES
1706
1ST OR 2ND WORD OSW ?
2ND CODE WORD
1ST CODE WORD
1708
PROPER I.D. ?
NO
YES
1710
PUT OSW IN FIRST WORD BUFFER RECORD TIME RCVD
1712
DISCARD THE OSW
EXIT
EXIT
1714
1ST WORD IN BUFFER ?
NO
YES
1716
1ST WORD RCVD WITHIN 46MS ?
NO
YES
1718
DISCARD OSW IN FIRST WORD BUFFER
1720
DISCARD THE 2ND WORD OSW
EXIT
1722
COMBINE 1ST AND 2ND OSW'S INTO SINGLE COMMAND
1724
ACT ON THE COMBINED COMMAND
EXIT
1726
PROPER I.D. ?
NO
YES
1728
DISCARD THE OSW
EXIT
1730
PROCESS THE SINGLE WORD COMMAND
EXIT